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9212.3 (970)

United States Department of the Interior

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January 7, 1975

This paper was developed in conjunction with an analysis of research needs in Alaska. It expresses these needs but also the concept of total program management including the fire program. It provides a broad view of Fire Management in the future, both short and long range.

Sincerely yours,

THE ROLE OF FIRE IN THE ALASKA TAIGA

AN UNSOLVED PROBLEM

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DECEMBER, 1974

Physical. Alaska is the largest State geographically. It has the longest coast line of any state and reaches the greatest north-to-south and east-to-west extent. Alaska, however, has the smallest population as well as the greatest amount of undeveloped resources. That area lying south of the Brooks Range and primarily north of the Alaska Range has been called the "Interior." This vast area accounts for somewhere in the neighborhood of 220 million acres, or roughly 60 percent of the State's total land area.

Ecological. Nearly all of the Interior Alaska lies within the taiga, a circumpolar zone of predominantly coniferous forest with tall trees in dense stands along the southern edge which become progressively shorter and less dense toward the northern tree line. About half of the Alaskan taiga zone consists of subarctic forests and bogs, the other half of alpine tundra, bare rock, permanent ice and snow. Two outstanding environmental factors are fire and permafrost. The taiga is a fire system with the flora and fauna adapted to, or dependent on, frequent fires. Because of its northerly latitude, most of the general area of the taiga is underlain by continuous to discontinuous permafrost.

The 586,000 square miles of Alaska are geologically new along the coastal areas. The Interior and Arctic slope are cold-dominated,

delicately balanced ecosystems. These characteristics make much of this vast area extremely sensitive to man's activities. Land management practices acceptable in most other parts of the United States can upset tenuous ecological balances in Alaska, seriously impair the environment, and ultimately curtail resource development. To provide full protection of invaluable resources requires keen insight and skillful manipulation of a multitude of resource relationships, some of which are unique to Alaska.

Well over 200 million acres in the Alaska interior consists of non-forest or presently noncommercial forest lands that have a great potential for wildlife, watershed, and recreation. Much of the area is unique for it is underlain with permafrost. It is a very special kind of terrain, is extremely fragile to man's disturbance, and is located in a natural lightning environment. Fire ecology of this region has been virtually unstudied and therefore, a great lack of ecological information exists. Knowledge of the relationship of fire to the forest ecosystem (grasslands, bogs, soils, lakes, timber, and rivers) in Alaska is needed if we are to manage the resources wisely. Likewise, to effectively manage fires and implement adequate control measures, the results of control actions must also be evaluated.

Why Alaska Has A Wildfire Problem

The Interior of Alaska receives very little precipitation in the summer months. It has a semi-arid climate (similar to the high desert country of Arizona, Utah, and Nevada) and the resultant condition is a "green desert." The "green desert" generally gets its moisture from subsurface sources rather than from the atmosphere. Thawing permafrost is sometimes the source of this moisture. A perched water table is formed when thawing occurs and the impervious permafrost layer prohibits deep infiltration. The best sites for tree growth are on permafrost free areas usually found on south-facing slopes and along river bottoms.

Because of the long hours of daylight, higher temperatures prevail during more hours each day than mountain states in the "lower 48." The high temperatures are accompanied by long periods of low relative humidity. Thus conditions favor frequent fires, many of which are started by lightning.

Anchorage-Kenai area normally gets about 25 inches of precipitation each year. Clouds lose moisture as they pass up and over the Alaska Range and the Interior only gets about 12 inches of precipitation annually. Occasionally the area south of the Alaska Range has abnormally

warm dry weather and fires become a real problem. The disasterous Swanson River Fire on the Kenai in 1969, was the result of abnormally high temperatures, low humidities, lack of rainfall, high winds, and man's carelessness.

Contributing to the fire problem is the unbroken Alaska fuel blanket that extends for hundreds of miles. There are no fire breaks and very few access roads. Only major rivers such as the Yukon and Kuskokwim Rivers have sufficient width to halt the spread of large fires.

Nearly half of the 222 million acres of the central fire-prone area of Alaska is covered with tundra, an area larger than Montana. Tundra-covered soils are part of a group that is found in polar latitudes and at high elevations around the world. Mosses, lichens, and shrubs form a heavy mat that insulates the soil and slows melting of the frozen soil in the short summers. The mosses become very dry during the warm summer days and are a flash fuel.

Alaska's forests are in the Boreal Zone of North America and the climax species are white and black spruce. The lower branches of the black spruce generally hang close to the ground and have beard lichens growing profusely on them. These lichens are also a flash fuel. This vegetative

complex provides for both horizontal and vertical fire movement and a fire in Alaska's Interior forest typically becomes a crown fire.

A mid-season fire in a black spruce forest has very erratic behavior, particularly if the temperature is over 80° and there is a 10 to 15 mile per hour wind. A raging crown fire quickly forms a towering convection column which develops its own winds which further accelerates burning. Spot fires often appear far ahead of the main fire. When this type of burning condition exists, retardant and other initial attack forces have little affect on the fire.

In addition to the flashy nature of the surface fires, fires in the tundra moss burn downward. In very dry warm seasons the fires may burn into the ground for several feet. This occurred in 1969, and some large fires had subsurface burning when the winter snows arrived. Some of these fires burned beneath the snow cover and were a continuing problem during the 1970 summer.

Thunderstorms often start lightning fires in the tundra which do not immediately burn as surface fires because of fuel moisture in the surface from recent rains. The lower layers of moss may have been dry enough to sustain the incipient lightning fire. These subsurface fires burn hot enough to dry out adjacent vegetation and ignite it. When warmer, drier weather occurs these underground fires surface and spread rapidly.

The Problem.

Approximately 62 percent of Alaskan wildfires are caused by man and 38 percent by lightning. However, the lightning fires cause the greatest number of acres burned due to multiple occurrence and to their remote location. Man-caused fires occur primarily in high value areas near population centers and along the highway net. A total of 4,728 fires were recorded in the past 10 years.

The fire season begins in April with man-caused grass fires in the populated areas. As the grass turns green in late May and early June, this danger subsides. At this time lightning fires in the Interior begin occurring and usually continue through July and part of August. While lightning fires rarely occur after the first week in August the vegetation dries due to freezing night-time temperatures and man-caused fires again become a problem.

Although very little written substantiation is available that fires have occurred in this country for the past 100 years or so, it is quite easy to see that fires have for some time played an important part in shaping the composition of the vegetation of Interior Alaska. One has only to walk through or fly over portions of this vast country to see such evidence.

It has been estimated that, since 1940, well over 32 million acres of forest grassland, and low arctic tundra have been burned over in the Interior.

Despite technological improvements in fire control nearly 9 million acres have burned in Alaska in the past 10 years.

The Role of Fire In Alaska's Environment and the Need for Research.

For years most land managers and plant ecologists in the United States have viewed fire primarily as a destructive force in the forest. This thinking has been reinforced from time to time by disastrous fires which caused millions of dollars of damage to improvements and claimed hundreds of lives.

The Swanson River Fire in 1969, and the Island Lake Fire of 1970, both on the Kenai Peninsula of Alaska, burned in an urban environment and threatened cities. These types of fires are destructive and no reasonable man would argue that control action was not needed. However, fires which occur at a distance from populated areas may not be as destructive as has been generally viewed.

Recently ecologists and other research scientists have questioned the premise that all fires are bad and should be excluded from the forest.

They suggest that some fires may be beneficial and that land managers should use prescribed burning as a management tool in some instances.

Fire has been used as a tool in many parts of the world, both to reduce the amount of fuel in the forest to lessen the hazard of disaster and to encourage the growth of more desirable plant species. We hypothesize that in Alaska, at least on certain sites, fire may have three beneficial effects: (1) reduction of fuel accumulations; (2) alteration of the vegetative cover to more desirable species; and (3) restoration of site productivity by release of available nutrients.

Much more research is needed on the effects of fire on Alaskan ecosystems before fire can be used as a tool with predictable results. Two recently prepared papers 1/ review the research that has been done on the taiga of Alaska and Canada. The authors point out some of the knowledge gaps that exist. For instance, most people believe that fire in spruce will improve the area for moose habitat because the amount of moose browse will be increased. Rowe and Scotter point out that generalizations such as this cannot be made. Certain areas, particularly the uplands of the Precambrian Shield, do not produce

1/ Wildfire in the Taiga of Alaska, by Leslie A. Viereck; and, Fire in the Boreal Forest, by J. S. Rowe and G. W. Scotter. Quaternary Research, Volume 3, Number 3, October, 1973.

suitable browse following fires in black spruce and moose are scarce. This points up the need for a more detailed site classification to avoid such unwarranted generalizations.

Some fires in Alaska have resulted in noticeable erosion not associated with control efforts, while other fires apparently result in little or no erosion. Foresters in Alaska have speculated about the cause of the Great Kobuk Sand Dunes in the Kobuk River drainage and the Nogahagana Sand Dunes west of Huslia. Rowe and Scotter note there is evidence to indicate that similar dune-forming activity near Lake Athabasca in northwest Saskatchewan was caused by fire. Further research is needed to determine if fire is the cause of the dune activity in the Interior of Alaska. Fairly large areas of the Interior have fine sandy soil underlaying the moss. It appears probable that repeated burns during abnormally dry years could destroy the moss cover and initiate the dune activity. If research can confirm this, a higher level of protection may be needed for these fragile areas. In addition, stabilization methods for these areas need to be worked out if it is found that these dunes are encroaching on surrounding vegetation.

Some fire control tactics have resulted in long term damage to the environment. As a result, land managers have severely restricted

the use of heavy equipment in fire suppression efforts. Generally, bulldozers would only be used as a last resort to halt fires threatening improvements or other high value resources. Research is needed to define alternative methods of fireline construction.

The effect of fire on wildlife in the taiga of Alaska is still ill defined. In the paper, "Fire in the Boreal Forest" 1/ the authors have this to say about wildlife management:

> There is not enough quantitative information on the ecological effects of fire on the total environment in the boreal forest on which to base management decisions. The present need is for an understanding of features and functions of ecosystems, not on single resource as has so often been the case in the past. Until such time as research enhances understanding of fires as an ecosystems process, it will be difficult for land managers to assess whether the values of the resources to be protected are great enough to justify the costs, both financial and ecological, of protecting the boreal forest."

1/ Ibid.

Heinselman [1/] lists six alternative fire policies which had been suggested for the management of Wilderness Areas and Parks; Viereck suggests they might also pertain to remote areas of Alaska. They are:

1. Attempt fire exclusion and accept the slow but pervasive changes in plant and animal communities that inevitably follow.

2. Allow "safe" * lightning-caused fires to burn; allow also for some other wildfires that cannot be controlled, but extinguish the rest. If this option results in less than natural fire frequency and burned area, so be it.

3. Allow "safe" lightning fires to burn, allow for some other wildfires that cannot be controlled, but prescribe enough additional controlled fires to assure the natural fire regime.

4. Suppress all wildfires to the extent feasible, and duplicate the natural fire regime with prescribed-controlled fires.

5. Allow all wildfires to burn unchecked unless life or property are directly threatened, and hope that a natural fire regime will result.

1/ Ibid.

* Heinselman notes this option may be valid if there is little possibility of fires escaping to lands outside the wilderness or park.

6. Abandon the ideal of natural ecosystems and turn to full-scale vegetation and environmental manipulation by mechanical and chemical means, seeding, planting, and so on. Attempt to produce desired vegetation with the tools of forestry.

Alaska faces conflicts of enormous proportions as it seeks simultaneously to redistribute its land management responsibilities, increase economic development, and at the same time protect its beautiful but fragile environments. The technological knowledge needed to resolve these conflicts is dangerously inadequate.

The overall fire research need in the Alaskan taiga and associated environments is to develop a sound understanding of their ecology to serve as the base of knowledge for their protection and management. Some major problems in this general need are:

1. The susceptibility to, and dependence of, taiga on fire, and the need to understand ecological effects of fire on the ecosystem.

2. Insure that fire is fully integrated into the multiple-use planning process.

3. Insure that fire management plans and resource plans are compatible with fuel management.

4. Assure that fuel treatment techniques are compatible with management objectives and ecosystem maintenance or type conversion.

5. Understand prescribed fire as a management tool.

Land managers need current fire management information now. The Bureau of Land Management is presently refining their resource value classification system to guide fire control actions and use in the planning system. In addition, the fire danger rating system is now undergoing revision. National Forests are intensifying and updating multiple-use plans. The National Park Service began fire management programs during the summer of FY 1974 in all Rocky Mountain National Parks. These factors make ecology-fire research extremely timely.

A similar step-up of research is essential for Interior Alaska. The central issue here, more than in any other area in the United States, is the extent and nature of use and development that is environmentally permissible for the tundra, taiga, and wetland ecosystems. Correspondingly, what are the opportunities for meeting environmental constraints by husbandry measures? Permafrost soils, erosion, stream sedimentation, and site destruction are important major areas of study in Interior Alaska along with the thermal and chemical effects of fire, roads, and

resource management practices. What effect does fire have on Interior vegetation, and thus on wildlife habitat? What is a desirable fire control strategy? What economic opportunities does the timber resource offer? Interior Alaska's watersheds produce more than one-third of the fresh water runoff in the United States. How should they be managed? How can the conflicting forage needs of commercial reindeer herds, caribou, and moose be resolved? What compromises are necessary between waterfowl nesting habitat and moose and caribou grazing on the one hand, and oil exploration on the other? What are the recreation opportunities in this land of 3 million lakes, and how should they be developed? These are but a few of the questions, the answers to which are vital to Interior Alaska's future.

An adequate research program in Interior Alaska would be about 4-1/2 times the present level. Such research would backstop managerial decisions of the Joint Federal-State Land Use Planning Commission, Alaskan Natives, the enlarged State Land Management Agencies, and the proposed new National Refuges, Parks, and National Forests.

Alaska's long-range future obviously depends in large on what we learn and apply in the way of resource and ecological stewardship.

Wildfire in Alaska has stirred an ever increasing controversy on whether or not to control them. There are an array of positions in the controversy with wildfire becoming increasingly important from an ecological and economic point of view. Environmental groups and the public in general are reflecting increasing interest and concern centered around the role of fire in perpetuating the ecosystem on one hand and in the destruction and waste on the other.

Fire research and training programs will improve the ability of land managers to predict fire behavior and fire effects. These predictions are essential for the success of fire management plans, especially when decisions concerning modified fire suppression and fire-use must be made. More and more often questions are being raised about the proper role of fire in wildland management and about present fire control policies. Some view the present situation as detrimental to the continuance of certain ecosystems. They claim that many of our most desirable plants require fire in some stage of their life cycle in order to retain their natural place in the environment. They also point to the accumulations of fuel where neither natural fires nor prescribed fires are allowed to burn. They predict dire consequences in the form of catastrophic fires and the gradual loss of valuable fire-dependent plant communities.

The Department of the Interior recently (11-1-74) revised its wildland fire control and management policy. It now reads, in part, as follows:

> 590.1.3(c)
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> Prescribed fires, which may include ignition by natural causes, may be used to achieve agency land or resource management objectives under approved and coordinated plans.

The Bureau of Land Management needs more information on fire effects before this policy can be optimally implemented in Alaska.

Distances are great in Alaska with no access to most areas except by air. Men, equipment, and supplies must be moved in by aircraft. It is not often practical to move in heavy equipment, or it takes too long to get the equipment in to be effective. With hundreds of men scattered over the State in dozens of locations, logistical support and communications become major problems requiring high expenditures for helicopters, cargo aircraft, and radios.

Fire costs in Alaska are extremely high for these and other reasons. During the period 1965 through 1973, the average cost per fire (pre-suppression and suppression) was nearly $26,000. Total suppression costs alone for that period were 80.9 million dollars.

Recent record-breaking dry seasons combined with large numbers of lightning fires have created fire loads larger than first-attack forces could handle. Once a fire spreads to several thousand acres in a remote timbered location, the costs of suppression become extremely high, without assurance that the fire can be controlled by man's actions alone. There is a lack of information as to what is the value of land in Interior Alaska. Without this economic input it is difficult for managers to make judgments about how much money is justified for wildfire suppression.

One of the primary considerations in fire control planning is resource value and potential loss which would result from fire. At the present time there are no objective methods to assess the gross or net effects of fires in Interior Alaska. About the only item which can now be objectively evaluated is timber loss. Depending on the conditions under which a fire burns and the management objectives a fire can be good or bad. Fire Control must have information regarding effect of fire under various conditions in order to plan and perform its function properly.

Fire protection on lands under new ownership will continue to be handled largely by the Bureau of Land Management and to an increasing

extent by the State of Alaska. To maintain the fire-oriented ecology of the taiga may require large amounts of prescribed burning and a different approach to the management of wildfires.

An important need in Interior Alaska is to help the land manager gain an appreciation of the possible uses of fire management. Fire management is the integration of fire protection, prescribed fire, and fire ecology knowledge into multiple-use planning, decision making, and land management activities. Fire management is not a program of "letting fires burn." Fire management places fire in perspective with overall land management objectives to fulfill the needs of society, optimize the productivity of land, and sustain environmental quality. Fire is evaluated not only for its potential to do damage, but also for its beneficial role in many ecosystems. Along with the"good" and "bad" aspects of fire, the impact of suppression techniques on the land and the effects of all land management activities on fire potential are assessed. Successful fire management depends on effective fire prevention, fire control programs, and land management planning that considers fire and ecological relationships.